COLOURED LABELS

The present invention relates to the field of coloured labels such as (but not limited to) those labels fixed to an article with an aqueous adhesive applied thereto (so-called wet glue labels). Preferably the invention relates to those labels which achieve a no-label look on the article. Any suitable labels may be used in the invention such as labels comprising coloured transparent and/or translucent bio-polymeric films, for example films made from cellulose and/or polylactic acid.

Labels made from thermoplastic films have been conventionally fixed onto an article with pressure sensitive adhesives (herein denoted as PSA) pre-coated onto the label facestock. Such label films include polyolefins, e.g. biaxially oriented polypropylene - BOPP). A PSA label facestock is dispensed from a release liner onto the article to be labeled. An alternative labeling method often used with a paper labels is to use a separate adhesive dispersed in an aqueous medium. The adhesive is applied as the label is fixed to the article. These are often referred to as wet glue labels but can also be called cold glue labels or just glue labels.

The market for alcoholic beverages such as beer, wine or spirits is more and more competitive and breweries need to find ways of capturing their audience and enticing them to purchase their product. Packaging is a major part of the promotional mix especially at point of sale in supermarkets and the drive for differentiation amongst the manufacturers is furious.

Recently a 'no-label' appearance has become fashionable for PSA labels as retailers have found many advantages from this new form of shelf appeal. The appearance of no-label is achieved by applying a transparent and/or translucent label to the article. If the label is transparent, printing on its reverse side (i.e. the "interior" side to be adhered to the article) appears to be directly applied to the article hence the term "no-label look". Such interior coats are better protected from wear and tear (rubbing, attack by solvents etc) as they are not on the exterior of the article.

However due to the process used to apply a wet glue label the conventional transparent plastic films (OPP, polyester- PE, polyethylene phthalate - PET) currently used in the PSA market have various disadvantages when used as the facestock for a transparent wet glue label. The properties of these thermoplastic films are different from the paper labels used on conventional wet glue machines.

For example thermoplastic films have a higher barrier to moisture (they are not semi-permeable to water) and this causes a wet glue to take longer to dry (and hence more time for the label to fix in place) which can be disadvantageous on a high speed labelling line or where precise location of the label on the article is required. Thus thermoplastic films are not an ideal replacement for a paper label on a conventional production line set up to apply a wet glue label to an article such as a bottle. Aqueous coatings are also not easily compatible with and do not adhere well to such thermoplastic films which are often hydrophobic without surface treatment of the film.

The substrate conventionally used to prepare wet glue labels is paper which is not transparent. Thermoplastic films can be transparent but because of the previous stated disadvantages with thermoplastic films and wet glue coatings, it has been necessary to use pressure sensitive adhesives to provide an article with a no look label having acceptable performance. Thus manufactures currently using labelling equipment for paper wet glue labels are faced with a significant capital outlay and disruption to change to equipment compatible with pressure sensitive labels if they wish to move to a no-label look.

The applicants co-pending application PCT/EP02/02726 describes use of wet glue method to apply a clear biopolymeric label (such as a cellulose film) to a transparent article to achieve a clear -label look without PSA. This method can use existing machinery suitable for paper wet glue labels yet allows use of biopolymeric labels which have various advantages over paper. The biopolymeric labels can be transparent or translucent to achieve a no-label look. A wet glue on a biopolymeric substrate can also dry in a reasonable time without the need to use exotic coatings. This method now provides an alternative route to a clear-label look for manufacturers without the disadvantages of changing an existing label line from wet glue to PSA. The contents of PCT/EP02/02726 are incorporated herein by reference.

However surprisingly the applicant has found that there are still issues that remain to provide an acceptable no-label appearance using a wet glue label compared to a PSA label.

PSA labels have the pressure sensitive adhesive pre-applied during the production of the label stock. In contrast the wet glue process requires that a wet adhesive is applied in situ to the label. The wet glue is applied to a glue roller then transferred to rubber covered palettes which transfer the glue onto the reverse of the label. In turn, the label is applied to articles such as glass or PET bottles at typical output speeds between 300 and 500 plus articles labelled per minute. At these line speeds and particularly with a range of conditions such as wet and dry and warm and cold bottles the applicant has found that the adhesive transfer

characteristics of wet glue have been difficult to optimise to achieve a satisfactory no-label appearance of a wet glue label on a bottle comparable to the no-label appearance of a conventional PSA label.

For example the applicant has found while a label of a clear cellulose film can be applied to a clear flint glass bottle using a wet glue to achieve an acceptable appearance, unexpectedly this is not the case when coloured bottles are used. For example wet glue labelling coloured green, amber, brown or black glass bottles with clear cellulose labels or labels of thermoplastic polymer does not achieve a satisfactory no-label appearance. Without wishing to be bound by any mechanism the applicant believes that due to the method of applying the adhesive there will be more under label defects compared to a PSA label. What is surprising is that these blemishes can more readily be seen with a clear transparent label on a transparent coloured article (such as a coloured glass or PET bottle) thus spoiling the illusion of a no-label appearance. Again without wishing to be bound by any mechanism the applicant speculates that this may be due to non-optimal optical contrast properties in the label / adhesive / bottle assembly.

Therefore if this unexpectedly observed problem is addressed it would enable a satisfactory or improved no-label appearance to be achieved by a wet glue label on a wider range (preferably any) colour or luminosity of article to be labelled, more preferably where the article (as well as the wet glue label) is translucent or transparent.

Although the disclosure herein relates mainly to wet glue labels made from biopolymers (especially cellulose and/or polylactic acid) it will be appreciated that if a satisfactory means can be found to apply wet glue to other transparent or translucent facestock (e.g. thermoplastic film such as polyolefins for example BOPP) then the present invention applies equally to these substrates as the problem identified and solved herein arises mainly due to the nature of the wet glue label process compared to that used for PSA labels.

Various documents exist which teach that optical properties of a label facestock or label adhesive may be modified.

EP 0664534 A (Fuji Seal) discloses a heat shrinkable label (optionally made from a film of ethylene-vinyl acetate copolymer with an amount of vinyl acetate in the range of 1 to 6% by weight) where the refractive index of the label is in the range of 1.512 to 1.516 in the circumferential direction when fitted to the container, and is in the range of 1.513 to 1.520 in the vertical direction of the container, so that it is even more unlikely that wrinkling, slackening,

etc. occur on a surface of the label when heated, as compared with a conventional label made of a polyethylene film. This deals with a completely different problem faced by a separate type of label to that of the present invention.

Some documents in the field of PSA labels teach of specific refractive index values for a PSA used in a transparent label.

EP 1124213 A (Heineken) discloses a clear PSA label where the PSA layer has at least one inorganic particulate material having a particle size not exceeding 50 µm and having a refractive index of between 1.4 and 1.6. This is stated to improve the transparency of the label of the bottle.

WO 0130933 A (3M) discloses PSA labels where the pressure-sensitive adhesive has a refractive index of at least 1.48. The pressure-sensitive adhesives comprise at least one monomer containing a substituted or an unsubstituted aromatic moiety.

References in the field of PSA labels are not relevant to the problem discovered by the applicant in the field of wet glue labels.

US 6306242 (Dronzek) discloses a method of applying a polymer label to an article with a hydrophilic adhesive by curing the label in situ after it has been applied to the article. On col. 5 lines 30 to 32 (and again on col. 8 lines 46 to 49) the polymeric substrate for this hydrophilic adhesive is stated to include "*clear, opaque or colored polypropylene*". This document does not appreciate the particular problem faced with achieving a no-label look using wet glue with a transparent label as for example no distinction is made between clear and coloured labels.

It is an object of the invention to solve some or all of the problems identified herein, for example to provide a method of labelling articles with an improved no-label look.

In general the following subscripts are used herein and in the claims to denote various colour space parameters and measurements made herein:

"L+A" denotes a measurement made in a labelled region of an article i.e. in transmitted or reflected light (preferably in reflected light) through the combination of both a translucent or transparent label in situ (including its wet glue) and the translucent or transparent article;

"L" denotes a measurement made in transmitted or reflected light (preferably reflected light) through a plain (i.e. unprinted) translucent or transparent label including (unless otherwise specified) through the wet glue applied to the side which will be the label interior side when on the bottle; and "A" denotes a measurement made in transmitted or reflected light(preferably

in reflected light) through translucent or transparent article (or translucent or transparent sub region thereof) unlabelled and without any wet glue applied.
Unless otherwise specified herein colour space measurements were taken from the front side of the sample as seen when the sample is located on the labelled article and the measurements were performed in reflected light .

In one method used in accordance with the present invention differences are measured between the labelled and unlabelled articles directly.

In this method ΔC, ΔL, ΔE and ΔH are defined in Equations 1 to 4 as follows (and where L, a and b are measured directly from the relevant sample):

$$\Delta C = C_{L+A} - C_A \qquad \text{Equation 1}$$

where $C_{L+A} = (a_{L+A}^2 + b_{L+A}^2)^{1/2}$ and $C_A = (a_A^2 + b_A^2)^{1/2}$

$$\Delta L = L_{L+A} - L_A \qquad \text{Equation 2}$$

$$\Delta E = [\Delta a^2 + \Delta b^2 + \Delta L^2)^{1/2} \qquad \text{Equation 3}$$

where $\Delta a = a_{L+A} - a_L$ and $\Delta b = b_{L+A} - b_L$

$$\Delta H = (\Delta E^2 + \Delta L^2 + \Delta C^2)^{1/2} \qquad \text{Equation 4}$$

Preferably and independently in each case labelled bottles of the invention exhibit the following values.
The modulus of ΔC is less than about 5, more preferably less than about 4, most preferably less than about 3.5, for example about zero.
The modulus of ΔL is less than about 7, more preferably less than about 4, most preferably less than about 3, for example about zero.
The modulus of ΔE is less than about 8, more preferably less than about 6, most preferably less than about 4, for example about zero.
The modulus of ΔH is less than about 7, more preferably less than about 5.5, most preferably less than about 2.5, for example about zero.

Conveniently labelled bottles of the invention comprises those where the modulus of both ΔL and ΔE is less than about 4, more conveniently both less than about 3.

Values of ΔC, ΔE and ΔH have been selected by experiment to define the region of CIE colour space for a label with respect to a given article which leads to an acceptable no-label look when that label is applied by a wet glue to the article. Without wishing to be bound by any theory the applicant believes that this is where the visual contrast between the label / adhesive / bottle assembly and the bottle is sufficiently low to achieve a no-label look.

However the applicant has found that a specific range for ΔL (matched luminescence) is also required so an otherwise matched coloured label can produce a satisfactory no-label look. Without wishing to be bound by any theory the applicant believes that appropriately selecting luminescence in addition to the other CIE parameters also helps to disguise visual blemishes caused by defects in the wet glue layer. An upper limit on the value of ΔL also ensures that a dark (e.g. black) label is not selected for use on a light (e.g. clear) bottle which would self evidently not result in a no-label look.

CIE L, C, H colour space differences (cylindrical co-ordinates corresponding to the CIE Cartesian colour space L, a, b) are measured conventionally herein as the difference between the labelled article and the unlabelled article measured in reflected light through a transparent sample.

Each of the above parameters used herein is otherwise measured and/or defined as set out in the Commission Internationale d'Eclairage (CIE) standard CIE94 or by analogy with the methods used in this standard. The measurements were performed under standard reference test conditions as defined in CIE94 (except as modified herein) namely: CIE D_{65}, CIE 10^0 Observer, 1000 lx illuminance, gray background, minimal specimen separation, homogeneous specimen structure and normal colour vision and measurements made in reflected light as defined herein.

In an alternative or additional method used in accordance with the present invention differences are measured between the coloured sample and a clear uncoloured standard (label, labelled article and unlabelled articles).

As used herein a colour ratio in transmitted light (also denoted R_{trans}) may be given from the ratio of the colour of the composite labelled article to the average colour of the separate label and the article. This can be defined in Equation 5 as:

$$R_{trans} = \frac{2\,(E_{L+A})}{(E_L + E_A)} \qquad \text{Equation 5}$$

where

$E_{L+A} = [(a_{L+A})^2 + (b_{L+A})^2 + (L_{L+A})^2)]^{1/2}$, which describes the colour for the transparent / translucent region of the article with label attached thereto, as the sample;
$E_L = [(a_L)^2 + (b_L)^2 + (L_L)^2)]^{1/2}$, which describes the colour for the label, as the sample; and
$E_A = [(a_A)^2 + (b_A)^2 + (L_A)^2)]^{1/2}$, which describes the colour for the transparent / translucent unlabelled article (such as a transparent bottle), as the sample.

Preferably for optimal colour matching the modulus of transmitted colour ratio R_{trans} is greater than 0.9 preferably is substantially about 1.0.

The transmitted colour ratio R_{trans} which uses a composite measurement for the label plus article together can be distinguished from results obtained from more conventional colour matching which is based on reflected light. Two transparent coloured objects side by side may look the same, but when stacked on top of each other the colour can change and as such the methods described herein are superior in identifying and selecting that colour of wet glue label which is required to achieve an acceptable no-label appearance on a translucent article of given colour.

Values for R_{trans} and the equations herein can be used to determine optimal colour values for a label E_L to achieve a satisfactory no-label look for a given article of specified colour values E_A and given the other values specified herein as optimal for example for parameters such as ΔC, ΔH and ΔL.

The present invention relates to the surprisingly discovered need to minimise the visual sensation of contrast between the label and the bottle and its contents. Contrast can arise from differences in luminance. The applicant has surprisingly discovered that the acceptability of a no-label appearance depends on the intensity of scattered/reflected light from reflected and transmitted light through the sample. Contrast can also be at constant luminance due to differences in colour. Contrast can thus be defined in terms of standard (CIE Lab) measurements of colour and luminance (i.e. L a and b values). The optimum values are where the CIE differences between bottle and contents and film are as small as possible i.e. approach zero.

The applicant has also unexpectedly discovered that to a first approximation other parameters of the label or bottle (such as refractive indices, amount of reflection or difference between bottle surface and label or spectral analysis of glass versus label film) are less important to achieve the no-label appearance and need not be considered here.

Therefore broadly in accordance with the present invention there is provided a coloured, transparent / translucent polymeric label which is capable of being fixed to a pre-selected coloured transparent / translucent region of an article by a wet glue process to achieve a non-label look on the article, characterised in that: the colour parameters measured in CIE colour space of each of the label, labelled article and un-labelled article together satisfy conditions (a) and/or (b)

(a)(i) the modulus of ΔC is less than about 10, preferably less than about 5, more preferably less than about 4, most preferably about 3.5, for example about zero, (such as ± 0.5), where:

$$\Delta C = C_{L+A} - C_A \qquad \text{Equation 1}$$

where $C_{L+A} = (a_{L+A}^2 + b_{L+A}^2)^{1/2}$ and $C_A = (a_A^2 + b_A^2)^{1/2}$;and

(ii) the modulus of ΔL is less than about 7, preferably less than about 4, most preferably about 3, for example about zero, (such as ± 0.5), where:

$$\Delta L = L_{L+A} - L_A \qquad \text{(Equation 2); and}$$

(iii) the modulus of ΔE is less than about 10, more preferably less than about 6, most preferably about 4, for example about zero, (such as ± 0.5), where:

$$\Delta E = (\Delta a^2 + \Delta b^2 + \Delta L^2)^{1/2} \qquad \text{Equation 3;}$$

where $\Delta a = a_{L+A} - a_L$ and $\Delta b = b_{L+A} - b_L$; and

(iv) the modulus of (ΔH) is less than about 7, more preferably less than about 5.5, most preferably less than about 2.5, for example about zero, (such as ± 0.5), where:

$$\Delta H = (\Delta E^2 - \Delta L^2 - \Delta C^2)^{1/2} \qquad \text{Equation 4}$$

and/or

(b) the modulus of transmitted colour ratio R_{trans} is greater than 0.9 preferably is substantially about 1.0, where

$$R_{trans} = \frac{2(E_{L+A})}{(E_L + E_A)} \qquad \text{Equation 5}$$

The term "transparent" means 'to show through' whereas the term "translucent" means 'to transmit and diffuse light so that objects beyond cannot be seen clearly'. However in the context of the present invention (unless clearly meant otherwise) the terms translucent and transparent have been used herein interchangeably and the one term may be replaced by and/or has be used to imply the other throughout the specification and claims herein.

It will be appreciated that the any suitable transparent and/or translucent wet glue label facestock in combination with any suitable wet glue may be coloured as described herein to achieve a no-label appearance. Preferred wet glue labels that can be coloured as described herein are those preferred, embodied and exemplified in PCT/EP02/02726 but optionally any transparent and/or translucent labels also described in US 6306242 may also be coloured as

described herein. More preferred facestock is cellulose, BOPP and/or polylactic acid film, most preferred is cellulose film or polylactic acid film, for example cellulose film.

Unless otherwise specified herein where necessary the wet glue used to obtain the colour space values herein is the conventional wet glue described in the examples herein.

The method of colour matching as described herein can be achieved by any suitable known method to colour a label for example one or more of the following and/or combinations thereof:

a) colouring the label film directly by incorporating dyes and/or pigments therein;
b) applying coloured lacquers to either or both surfaces by any suitable application method;
c) colouring the surface of the substrates with coloured inks by any suitable print process;
d) colouring a conventional clear wet glue in order to produce coloured translucent adhesive used in conjunction with a clear film; and/or
e) colouring both the label film and the wet glue applied thereto

It will be further appreciated that the total desired colour of the label plus wet glue may be achieved by a partial combination from any of the above (or other) methods and/or by selection of a specific available colour of any suitable commercially available coloured film from a product range, should the known the film be measured to have the desired colour space values as calculated herein.

Colouring can be achieved by use of pigments; dyes, such as powder dyes, liquid dyes, reactive dyes; and/or encapsulants of dyes and/or pigments.

Colorants which have been found to be used in the method of the present invention comprise:a blend of Crisofeniana G280 (yellow), Rojo Eliamina 8BLEC (red) and Azul Marina 15 REC (blue); or a blend of direct Yellow Colour Index (60% w/w), Direct Red Colour Index 81 (10% w/w), and Acid Blue Colour Index 113 (30% w/w).

However it will be appreciated that the specific colorants and the absolute and respective concentrations used will vary in each case as they depend on the colour space values which are required for the film and/or adhesive to achieve an improved no-label look on the selected article to be labelled. These values can be calculated for a given article as described herein.

For a regenerated cellulose film the colorant can be added into the liquid comprising dispersed cellulose (such as viscose) from which the cellulose film is regenerated. The process for colouring film can be achieved by a single calculation to achieve a suitable colour according to the method of the invention described herein.

Alternatively colouring can occur in real time as the label is applied to each article, for example by colouring the wet glue just before it is applied to the label. In this embodiment optionally the colour of each article to be labelled can be sensed by suitable means (e.g. a camera or other sensor) and this information can be used to adjust (e.g. by a feeder of other means) the concentration and/or respective mix of the colorant(s) added to the adhesive applied to the next article to be labelled. This method provides a means to adjust for variations in the colour of individual bottles or batches of bottles (e.g. from different suppliers) so that the no-label look appearance of the labelled bottle remains optimal.

Such a method of colouring the adhesive can also be used in combination with a coloured film. A film colour can be selected as described herein to provide an optimal no-label look for the average colour of the articles to be labelled. The wet glue can then be coloured in real time on the labelling line to adjust for smaller colour variations for each article and fine tune the no-label look appearance of each article.

The present invention of colour matching the label to the article shows some or all the following benefits (relative to a clear label):

Improved merging of the edges of the applied labels especially seen with with brown glass bottles.

Improved masking of the micro bubbles trapped in the adhesive layer between the bottle surface and the inner face of the applied labels.

Improved masking of transferred marks or blemishes on the rubber plate, thus significantly widening the operating window with regard to surface defects or finish of the rubber application palettes used on a bottle line to transfer adhesive to the labels.

Improved opacity of surface printed white inks which allows labels to be printed by the off set litho sheet fed process currently used to print the bulk of paper wet glue labels.

Elimination of the "wet T-shirt effect " seen when a single hit white ink is used as part of the label design colour palette.

The label can be precisely matched to an article of any colour so a no-label appearance can be achieved for a much wider range of articles.

Thus one aspect of the present invention provides a method of reliably and reproducibly predicting in advance the colour and/or luminosity required of a label film to achieve a no label appearance when said label is applied by a wet glue method to a translucent article of given colour and luminosity (defined by its position in CIE colour space). This is because the applicant has defined using the equations herein and parameter limits given herein for the variables in said equations a region of colour space relative to the article which the applicant has found by trial and error is sufficient to disguise the blemishes which unavoidably result from the wet glue method (compared say to a PSA label) when the labelled article is viewed in transmitted and/or reflected light through the transparent / translucent label - article assembly.

Further aspects, embodiments and preferred features of the invention are described in the claims.

The present invention is illustrated by the figures herein which are photographs of five bottles to which respectively as a comparison a clear, transparent cellulose label (Figure 1) and coloured (different browns) transparent cellulose labels of the invention (Figures 2 & 3) had been applied by a wet glue process.

The present invention will now be described in detail with reference to the following non limiting examples which are by way of illustration only. Firstly some common procedures are described.

Label preparation

Cellulose label film was produced as follows for both comparative labels and labels of and used in the method of the present invention as follows. A production machine was set up in a conventional manner to produce regenerated cellulose film from the well known viscose method. The viscose used had a cellulose content of 9.3% and the resultant film had a substance of 62 grams per square metre uncoated and 64.5 grams per square metre coated. Where a colorant was omitted the resultant film was a conventional clear and transparent cellulose film such as that available commercially from UCB under the trade mark Cellophane® 645 E711. In an alternative embodiment cellulose films with a substances of 75 grams per square metre uncoated and 77.5 grams per square metre coated were also prepared and gave satisfactory results in the method of the present invention when tested analogously to the exemplified films herein.

Optional label colouring

Optionally a suitable (e.g. brown) dye or pigment can be added to the viscose stream to be absorbed into the regenerated film. The colorant (type and concentration) may be selected such that the colour of the resultant film web satisfied the equations herein with respect to previously measured colour space values for the coloured (e.g. brown) glass bottles to be labelled. This produces a resultant film which is transparent and of the required colour to achieve a no-label appearance on a given coloured glass bottle (e.g. dark brown bottle filled with a very dark beer).

Adhesive

One side of the optionally coloured cellulose film prepared as described above was coated with a conventional coating of vinyl chloride / vinyl acetate copolymer at a coat weight of 2.5 g per m^2. A standard wet glue synthetic adhesive (50% water) was then applied to the same side as the copolymer during labelling by a conventional wet glue labelling apparatus. The applicant has found that this adhesive may be applied at coat weights from 2.5 to 3.5 g per m^2 and will still give satisfactory performance in the method of the present invention.

Bottles

Except where indicated the same type of clear bottle was used in each of the examples herein. However the bottles tested were filled with a solution of various dyes denoted B, C, D & E (or 'e' in the Figures 1 to 3) to mimic the effect of a range of various (brown) coloured bottles. Four particular shades and hues of brown liquid were prepared and in each case the same shade and hue of brown was denoted by the same letter B to E (in Figures 1 to 3 herein). It will be appreciated that it is irrelevant how the given colour was (as defined by CIE data herein) is achieved, for example B to E may be made a selection of a suitable dye(s) separately for each sample and/or the same dye(s) used at different concentrations in each sample. For comparison the labels were also applied to the empty clear bottle (denoted A). This technique provided a ready means to test many different shade and hue combinations of brown label on (simulated) brown bottle. It will be appreciated that this was for convenience as it was more difficult to obtain bottles having various graduations of brown.

Labelling

The label films were applied to the bottles in a conventional way using unmodified (or only trivially modified) conventional labeling equipment set up for wet glue paper labels, to achieve a transparent label thereon.
Using the method described herein (and in Equations 1 to 5 herein) the following CIE values were determined from experimental data for various labels applied to various glass bottles.

Results

The colour space co-ordinates (CIE) for the various bottle / label combinations were measured conventionally in reflected light. The CIE data (Modulus values) obtained were given in the Tables below to 2 decimal places (dimensionless, no units). For each example there is a pair of data sets where #(i) refers to the bottle (whether empty or full as indicated) before labelling and #(ii) is data obtained after the relevant label had been applied. NA denotes "not applicable" (e.g. No-look label, ΔL, ΔH, ΔC, and ΔE were not determined for unlabelled bottles).

Comparative Examples

The following comparative examples were prepared (Comps. I to VIII)

Labels (Comp I & II)

Comp I was a label prepared from clear uncoloured transparent cellulose available commercially from UCB under the trade mark Cellophane® 645 E711.

Comp II was a label where the colorant added to the cellulose was a blue colour unmatched (i.e. not satisfying the Equations 1 to 4 herein) to the colour of the brown bottle which was labelled.

Labelled bottles

Clear labels (Comp III to VII)

Comp III to VI are various comparative labelled bottle made using clear cellulose label applied (as described above) to a bottle of clear glass optionally filed with various brown dyes B to E.

Table 1

Comp	Dye	No-look label	L	a	b	ΔL	ΔH	ΔC	ΔE
III(I)	A (none)	NA	26.15	0.45	-0.89	NA	NA	NA	NA
III(ii)	A (none)	Pass	28.61	0.77	-0.52	2.46	0.49	-0.07	2.51
IV(i)	B	NA	24.16	1.16	0.11	NA	NA	NA	NA
IV(ii)	B	Pass	26.21	0.69	-0.76	2.05	0.98	-0.14	2.27
V(i)	C	NA	22.21	0.72	-0.51	NA	NA	NA	NA
V(ii)	C	Fail	27.89	0.22	-0.63	5.68	0.46	-0.22	5.71
VI(i)	D	NA	20.13	0.05	-0.94	NA	NA	NA	NA
VI(ii)	D	Fail	27.86	-0.01	-1.06	7.73	0.06	0.12	7.73
VII(i)	E	NA	25.21	0.19	-1.72	NA	NA	NA	NA
VII(ii)	E	Fail	30.56	-0.11	-1.30	5.35	0.29	-0.43	5.38

Each labelled bottle was visually inspected and given a crude "pass" or "fail" based on the blemishes seen on the label in reflected light and the overall illusion of no-label. Photographs of the labelled bottles evaluated are shown in Figure 1 herein. As can be seen from the data the applicant has surprisingly discovered (and contrary to what might be expected) not all clear (uncoloured) transparent labels are able to produce a satisfactory no-label look when applied to a bottle. This can be seen for example from Comps. V to VI when clear labels when applied to a dark coloured bottles ((simulated) brown bottles C to E) exhibit an unexpectedly high value for ΔL (luminance). Without wishing to be bound by any theory the applicant believed that (luminant) blemishes caused by uneven application of the adhesive can be seen particularly well through the clear label against the background of a dark bottle

Colour mismatched label and bottle (Comp VIII)

For a further comparison a dark labels on a dark bottles was prepared where a blue cellulose label coloured as described herein was applied to a brown bottle and measured as described. This labelled bottle failed the no-look label test.

	ΔL	ΔC	ΔH	ΔE
Comp VIII = Brown Bottle / Comp Label II	6.3	7.76	7.54	12.52

The applicant has provided a means to solve the above identified problem as illustrated by the following examples according to the present invention.

Examples 1 to 10

Bottles were labelled according to the invention as follows with reference to Tables 2 to 3 and Figures 2 to 3 herein.

Labels

For each of the five bottles (one clear and four simulated brown) were labelled with a cellulose label as describes herein by a wet glue method. Two labels were used. Examples 1 to 5 used a dark brown label of a certain hue (denoted herein by B1) as shown in Figure 2 with reference to the data in Table 2. Examples 6 to 10 used a brown label of different lighter hue to B1 (denoted herein by B2) as shown in Figure 3 with reference to the data in Table 3. Conventional brown dyes were used to create (by the method as described herein) the two different shades (B1 & B2) of brown cellulose label used herein. These labels (B1, B2) were applied to a clear bottles and various brown colours were simulated using dyes B to E. The label was applied using the wet glue process as described herein.

Results

Each labelled bottle was then rated visually for an appearance of a no-label look based on the blemishes seen on the label in reflected light and the overall illusion of no-label, based on ranking criteria given in Table A for each of the parameters ΔL, ΔH, ΔC and ΔE. The mean of the ranking values was tabulated as the "no-label look rating" for each example tested. These labelled bottles were also photographed and these are shown in Figure 2 (Table 2) and Figure 3 (Table 3) herein.

Table A

Parameter↓ // Rating values →	0	1	2	3	4
ΔL	> 7.0	≤ 7.0	< 4.0	< 3.5	≈ 0 (±0.5)
ΔH	> 7.0	≤ 7.0	< 5.5	< 2.5	≈ 0 (±0.5)
ΔC	> 5.0	≤ 5.0	< 4.0	< 3.5	≈ 0 (±0.5)
ΔE	> 8.0	≤ 8.0	< 6.0	< 4.0	≈ 0 (±0.5)

The CIE values were then related to those label / bottle combinations which passed to confirm the validity of the method of the present invention for pre-selecting those labels which will create an acceptable no-label look for a given bottle.

Table 2 (Label B1)

Ex	Dye	"No-label look rating"	L	a	b	ΔL	ΔH	ΔC	ΔE
1i	A	NA	26.23	0.18	-0.32	NA	NA	NA	NA
1ii	A	2	25.03	0.54	4.86	1.20	2.55	4.52	5.33
2i	B	NA	22.89	0.51	-1.87	NA	NA	NA	NA
2ii	B	1¼	29.11	0.12	4.80	6.22	6.03	2.86	9.13
3i	C	NA	22.16	0.12	-2.16	NA	NA	NA	NA
3ii	C	2¾	23.99	1.28	1.52	1.83	3.85	-0.18	4.26
4i	D	NA	24.31	0.21	-1.11	NA	NA	NA	NA
4ii	D	2½	25.03	-0.15	4.50	0.71	4.50	3.37	5.66
5	E	NA	23.68	-0.12	-1.72	NA	NA	NA	NA
5ii	E	2½	25.26	-0.20	3.73	1.58	5.07	2.01	5.68

Table 3 (Label B2)

Ex	Dye	"No-label look rating"	L	a	b	ΔL	ΔH	ΔC	ΔE
6i	A	NA	27.27	0.33	-1.24	NA	NA	NA	NA
6ii	A	2¼	23.48	1.32	1.35	3.79	2.70	0.61	4.69
7i	B	NA	25.30	0.54	-1.57	NA	NA	NA	NA
7ii	B	2½	21.58	1.21	0.95	3.72	2.61	-0.12	4.54
8i	C	NA	22.93	0.07	-2.47	NA	NA	NA	NA
8ii	C	2¾	23.99	1.28	1.52	1.06	4.13	-0.48	4.30
9i	D	NA	22.44	-0.03	-2.01	NA	NA	NA	NA
9ii	D	3¼	22.79	1.32	1.10	0.35	3.37	-0.29	3.41
10i	E	NA	22.45	-0.12	-2.38	NA	NA	NA	NA
10ii	E	2¼	25.44	1.12	1.26	2.98	3.78	-0.70	4.87

Colorant

The brown labels B1 and B2 in Examples 1 to 10 herein were coloured as described herein (by addition to a standard viscose bath with the film web speed the same in each case) using the following colorant mixture added at respective weight ratios (B1 and B2) of 20 and 9. (Each dye was available commercially from Colorantes Industriales)

Colorant	Weight ratio
Direct Yellow Colour Index 12:	0.6
Direct Red Colour Index 81:	0.1
Acid Blue Colour Index 113:	0.3
Total	1.0

Examples 11 (i) to (vi) – Labelled brown bottle

Further dark brown glass bottles were labelled as described herein with reference to Table 4, these bottles are not shown in the photographs of Figures 1 to 3 herein. Various different coloured brown labels (denoted by Greek letters α to ε) were applied with a wet glue process to the same empty dark brown bottle. It will be appreciated that the given brown colour of label may be achieved by the selection of any suitable dye(s), pigment(s) and/or mixtures thereof at concentrations thereof. Each labelled bottle was tested as described above (Ex 11(i) was the unlabelled bottle) and the data is given in Table 4.

Table 4

Ex	Bottle	Label	Rating	L	a	b	ΔL	ΔH	ΔC	ΔE
11i	Brown	none	NA	24.93	0.61	5.18	NA	NA	NA	NA
11ii	Brown	(α)	3½	27.59	0.68	3.80	2.66	0.27	-1.36	3.00
11iii	Brown	(β)	3	26.48	1.51	3.99	1.55	1.15	-0.95	2.15
11iv	Brown	(γ)	3	22.17	1.39	3.04	2.77	1.29	-1.88	3.58
11v	Brown	(δ)	3¼	22.82	0.52	4.08	2.11	0.05	-1.10	2.38
11vi	Brown	(ε)	3	24.38	0.91	1.76	0.56	1.16	-3.23	3.48

These various brown labels (Examples 11(ii) to (vi)) were found to match the brown bottle to achieve a no-label look. A rating value calculated as for the "no label look rating" in Tables 2 and 3 above, compares favourable with the other examples. It can be seen that use of a colour and luminance matched label is particularly useful to achieve a no-label look on a dark coloured bottle.